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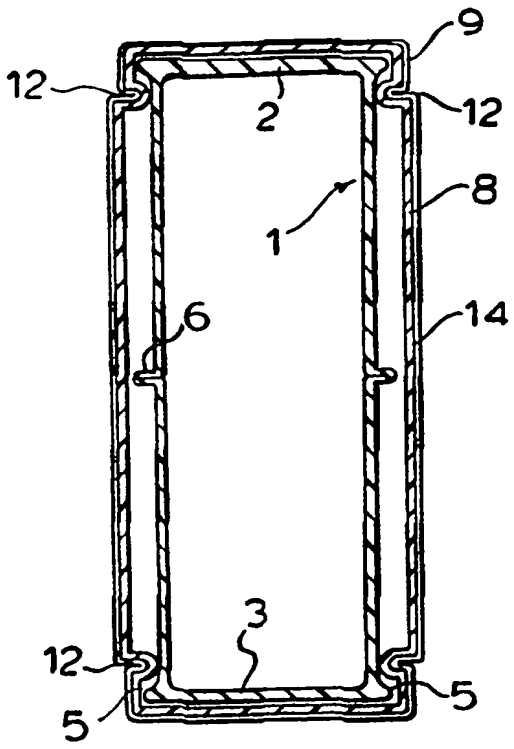
(54) Title: LOAD SUPPORTING BEAM AND SUPPORT THEREFOR

(57) Abstract

A load supporting composite beam for use in a building system employing hollow thermoplastic structural members interconnected by means of sliding joints. The beam comprises a metal beam (1, 15) and a hollow thermoplastic cover (7) therefor into which the metal beam (1, 15) is adapted to be sleeved. The cover (7) incorporates an interlock (12) for slidingly interlocking with the structural members of the system with which it is to be used. A bearing bracket (22) is also provided for supporting the ends of the composite beam (15) and a hold down clip (38) for clamping members to the composite beam (15).



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LOAD SUPPORTING BEAM AND SUPPORT THEREFOR

FIELD OF THE INVENTION

This invention relates to improvements in beams for supporting roof and other loads, and supports therefor for use in erecting modular building structures employing various interlocking hollow thermoplastic structural members.

BACKGROUND OF THE INVENTION

As discussed in my co-pending Canadian Application Serial No. 2,070,079, I have provided a novel and highly practical building system enabling the construction of building such as detached, single and multi family dwellings wherein such buildings are constructed from structural members made from vinyl chloride, eg. polyvinyl chloride (PVC) based composite material, and hollow interconnected by means of sliding joints.

These structural members are assembled to form walls - both interior and exterior - and to form the roof of the structure. The hollow elements may be filled with various materials such as concrete, (light weight or normal weight), insulating material such as urethane foam or other approved materials to permit the structural thermal, acoustical and other properties to be varied.

To ensure that the building systems have the widest application, the roofs of the building structures, in particular, must be capable of withstanding the enormous wind loads of hurricanes and like storms and the snow loads that can be expected under blizzard or arctic conditions.

SUMMARY OF THE INVENTION

The present invention is directed to providing a beam for supporting roof and other heavy loads and support structures therefor which will provide the requisite bearing capacity for roof loads and the like and which can be integrated into the aforesaid novel building system of interlocking thermoplastic structural components.

According to the invention the novel load supporting beam comprises a metal beam sleeved into a thermoplastic cover incorporating the interlocking means to adapt the beam for sliding interconnection with other thermoplastic structural members to enable the beam to be incorporated into the building system.

Further, according to another aspect of the invention, there is provided a novel support bracket arrangement for supporting the ends of the beam adapted for incorporation into the building system.

In the preferred form of the invention as it relates to the beam, the said beam comprises an extruded aluminum box beam, and the enclosing cover or sleeve is an extrusion formed with a core of reinforced polyvinyl chloride covered with a co-extruded smooth skin which may be of PVC material or the like.

Further, the preferred enclosing cover or sleeve is of rectilinear shape having top and bottom walls joined by side walls, said sleeve being provided adjacent the top and bottom walls thereof with locking grooves and with the sleeve outwardly of the grooves towards the top and bottom being of reduced width.

Further, again, the aluminum box beam is provided with end flanges to engage in said reduced cover sleeve widths.

Still further, the aluminum box beam is provided with lateral projections at opposite sides thereof intermediate its height to limit lateral inward cover sleeve movement.

In the preferred form of the invention as it relates to the beam end supporting bracket, the said bracket comprises a shelf having bottom sides and back panels formed of galvanized steel, the back panels being adapted to be mounted against a hollow wall member and having a plurality of spaced flanged arms projecting therefrom to be received within the hollow wall member, and to be anchored therein upon the introduction of concrete or the like into said hollow member.

More particularly, the flanged arms of the bracket have flanges projecting from the arms in right angular relation to anchor the bracket in right angular directions against forward and upward movement.

Further, the invention contemplates a hold down clip or member in the form of a plate having lateral projecting to engage under the bracket arms and a hold down flange to clamp a cap member on a beam secured in the support bracket.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

Figure 1 is a sectional view of the metal box beam component of the load bearing beam according to a preferred form of the invention;

Figure 2 is a sectional view of the thermoplastic sleeve or cover for the metal beam of Figure 1 showing the locking grooves to convert the

metal beam into a thermoplastic coated unit capable of slidingly interlocking with other thermoplastic structural members;

Figure 3 is a sectional view showing the metal beam of Figure 1 sleeved within the thermoplastic cover of Figure 2;

Figure 4 is a sectional view of an alternative form of the metal box beam component;

Figure 5 is a rear view of the composite beam supporting bracket;

Figure 6 is a vertical sectional view of the support bracket taken on the line 6-6 of Figure 5;

Figure 7 is a front view of the hold down clip showing how it engages under the beam supporting bracket arms;

Figure 8 is a part vertical sectional part side elevational view showing the bracket, composite beam, and clip assembled with a box connector;

Figure 9 is a side elevational view of the beam, beam cap, and clip mounted to a box connector with one wall of the box connector being broken away showing the box connector ready to receive concrete or the like;

Figure 10 is an end view of the assembly of Figure 8; and

Figure 11 is a top view of the assembly of Figure 8.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to Figure 1, there is shown a metal box beam 1 preferable extruded from aluminum which provides a good combination of

anchoring same in position with the flanges 28 and 29 resisting displacement in two right angular directions.

As shown in Figure 10, the composite beam, in this case formed by the sleeve 7 of Figure 2, and the aluminum box beam 15 of Figure 4 is provided with an extruded thermoplastic hollow cap generally designated at 34 which has locking fingers 35 interlocked with the composite beam grooves 12. This cap 34, which does not form part of the present invention, carries roof supporting surfaces 36 and is provided with a roof holding clip 37.

It will be understood that in the pouring of the concrete into the box connector 30, the openings required for introducing the flanged arms 27 of the bracket 22 will be suitably taped to prevent concrete from flowing into the shelf formation of the bracket.

Figure 7 illustrates a clip for use with the bearing bracket to guard against lifting of a roof carried by the cap 34 under very high winds. This clip designated at 38 has a plate-like body 39 having a reduced portion 40 which is adapted to span between the bracket arms 27 and is provided with lateral extensions 41, one to engage under the upper arm 27 projecting from one of the rear wall panels 26 and the other to engage under the upper arm extending from the other at rear wall panel 26.

At the upper end, the clip is provided with a flange formation comprising two outer flange portions 42 and a larger, central flange portion 43 which are adapted to overlie the composite beam and a surface of the beam cap 34 as illustrated in Figures 8, 9 and 10.

It will be understood that the clip 7 will be assembled with the bracket arms 27 prior to the introduction of the concrete into the box connector and when the concrete is set, the clip 38 will be anchored against upward movement by virtue of its projections 41 being engaged underneath the bracket arms. The clip then becomes a hold down member and as illustrated in Figure 8, it may be secured to the beam cap and the composite beam by means of suitable screws 44.

locking grooves 12 for slidingly interlocking with other mating thermoplastic structural members.

Such a composite beam as shown in Figure 3 provides a beam of requisite strength, for example, for bearing the roof load of a building structure with the beam being adapted to span between supporting wall members.

With particular reference to Figures 5, 6, 8 and 9, there is shown a suitable bearing bracket for supporting the end of the composite beam of Figure 3.

Figure 5 is a rear view of a preferred form of beam supporting bracket while Figure 6 is a vertical section taken on a line 6-6 of Figure 5.

The bracket generally designated at 22 is in the form of a shelf having sidewalls 23, a bottom wall 24, stepped as at 25 for strength and rear wall panels 26 from which project vertical arms 27 in a staggered relation as shown in Figure 5. These arms are provided with in-turned end flanges 28 and bottom flanges 29 as particularly seen in Figure 11.

The bracket 22 is adapted to be mounted against a hollow wall member which, as particularly seen in Figure 11, is a thermoplastic hollow box connector 30 having projecting arms 31 with in-turned fingers 32 adapted to slidably interlock with other wall forming members having locking grooves corresponding to the locking grooves 12 of sleeve 7.

It will be understood that the box connector 30 will be provided with suitable openings through which the vertical arms 27 can be introduced into the interior of the box connector with the arms 27 being lowered so that notches 33 on the underside thereof as shown in Figure 6 will come to rest on the bottom of slots formed in the box connector (not shown).

As discussed above, and as disclosed in my said co-pending application Serial No. 2,070,079, such box connectors are adapted to be filled with concrete or the like to give structural rigidity thereto to provide a permanent wall structure. It will be understood that when concrete is poured into and fills the box connector 30, it will embed the flanged arms 27

Such an extruded sleeve has its own inherent structural strength by virtue of the reinforced core while the co-extruded thermoplastic skin covers and seals the outer exposed surfaces of the core interlocking with any exposed core fibres and providing a means of imparting impact resistance, smoothness to facilitate sliding interlocking. Further coloring or other agents may be added to the sleeve if desired.

Thus, the extruded thermoplastic sleeve 7, in itself, forms a structural beam member having its own inherent load bearing capacity.

As illustrated in Figure 2, sleeve 7 is provided adjacent to its top and bottom walls 10 and 11 with interlocking groove formations 12 while outwardly thereof towards the top and bottom walls, the width of the sleeve is reduced as at 13.

With reference to Figure 3, the box beam 1 is shown as having been received or sleeved within the thermoplastic sleeve or cover 7 to provide a composite beam comprising the main load carrying box beam 1 and the covering sleeve with its own inherent structural strength adding to total beam strength.

It will be noted that the box beam flanges 5 are located in the reduced sleeve end spaces 13 while the nibs 6 of the box beam 1, while adding central thickness to the sidewalls 4, also will limit inward deflection of the sidewall 14 of the sleeve 7.

Figure 4 shows an alternative form of aluminum box beam 15 which may be used in place of the beam 1 for somewhat lighter loads. In this case, the top and bottom walls 16 and 17 are shown as having the same thickness as the sidewalls 18 while the outwardly projecting flanges 19 at the top and bottom walls 16 and 17 are shown thickened at the end 20.

Beam 15 is also shown as having central projections or nibs 21.

By the provision of the thermoplastic sleeve 7, the box beam 1 or 15 when received within the sleeve, are converted into what appears to be a thermoplastic building structure incorporating the means by way of the

extrudability and mechanical properties. Beam 1 is shown as having thickened top and bottom walls 2 and 3 and elongated side walls 4. The top and bottom walls 2 and 3 are provided with short, outwardly extending, reinforcing flanges 5 while the side walls 4 intermediate their height are shown as having short projections or nibs 6.

This aluminum beam constitutes a load bearing beam capable of sustaining substantial loads. However, such a beam is not adapted in itself for incorporation into an interlocking thermoplastic building system, both from the standpoint that it lacks the necessary interlocking connections and as well the aesthetic appearance of the thermoplastic structural members with which it is intended to be used.

To this end, there is provided an extruded thermoplastic sleeve 7 adapted to receive and encase the aluminum box beam 1 to convert the combination into an interlocking structure as well as adding structural strength as hereinafter more fully described.

To provide structure strength, the sleeve 7 is preferably formed of a reinformed thermoplastic inner layer or core 8 and a co-extruded outer skin designated in dotted lines at 9.

The core 8 is preferably extruded from a thermoplastic material reinformed in such a manner that the reinforced thermoplastic provides strength and expansion control yet is still flowable through an extrusion dye.

The thermoplastic material may be a vinyl chloride, e.g. a polyvinyl chloride (PVC) reinforced with mineral or other fibres or known expansion controlling agents such as calcium carbonate. In particular, the reinforcing agent may be very small, short, glass fibres of the order of a few microns in diameter and few millimeters in length in concentrations not greater than, and preferably substantially less than, 35% by weight based upon the combined weight of glass fibres and vinyl chloride resins.

The smooth plastic skin may be PVC, rigid PVC, semi-rigid PVC, ABS polycarbonate and the like.

The plate portion 39 of the clip acts for form a weir blocking concrete flow and adds to the containment of the concrete in addition to the taping of the openings in the box connector through which the arms 27 are inserted.

Preferably, the bracket 22 and clip 38 are formed of galvanized steel and it will be appreciated that the ends of the composite beam may be further connected to the supporting brackets 22 by screws or other fasteners penetrating the metal of the bracket and of the composite beam.

It will be understood that variations in the details of the composite beam supporting bracket and clip may be made without departing from the spirit of the invention or scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A load supporting beam for use in a building system employing hollow thermoplastic structural members interconnected by means of sliding joints, said beam comprising a metal beam and a hollow thermoplastic cover therefor into which said metal beam is adapted to be sleeved, said cover incorporating interlocking means for slidingly interlocking with the structural members of the system with which it is to be used.

2. A beam as claimed in Claim 1 in which said metal beam comprises a rectilinear aluminum box beam having top and bottom walls connected by side walls.

3. A beam as claimed in Claim 2 in which said metal beam has latterly extending flanges at the edges of said top and bottom walls.

4. A beam as claimed in Claim 3 in which said metal beam has latterly outwardly extending nibs intermediate the height thereof.

5. A beam as claimed in Claim 4 in which the depth of the metal beam is greater than its width.

6. A beam as claimed in Claim 3 or 4 in which the ends of said flanges are thickened.

7. A beam as claimed in Claims 3, 4 or 5 in which the top and bottom walls are thicker than said side walls.

8. A load supporting composite beam for use in a building system employing rectilinear hollow thermoplastic structural members adapted to be interconnected by sliding groove and finger joints, said beam comprising a rectilinear aluminum box beam of substantially greater depth than width and having short latterly extending flanges at the top and bottom thereof, and a rectilinear thermoplastic sleeve adapted to receive said aluminum box beam, said sleeve being formed with locking grooved adjacent to the top and bottom thereof and being of reduced width outwardly of said locking grooves

towards the top and bottom thereof, said locking grooves being adapted for interlocking connection with structural members of the system with which it is to be used, said aluminum beam having the flanges thereof located in the reduced width portions of said thermoplastic sleeve.

9. A composite beam as claimed in Claim 8 in which said aluminum beam is provided with lateral projections intermediate to the top and bottom thereof to prevent inward movement of said thermoplastic sleeve.

10. A composite beam as claimed in Claim 8 in which said thermoplastic sleeve is an extrusion having a reinforced thermoplastic core and a coextruded outer skin.

11. A composite beam as claimed in Claim 10 in which said core comprises a vinyl chloride having a reinforcing agent therein.

12. A composite beam as claimed in Claim 11 in which said skin is a polyvinyl chloride.

13. A composite beam as claimed in Claim 11 or 12 in which said reinforcing agent comprises short glass fibers.

14. In combination a load supporting composite beam for use in a building system employing rectilinear hollow thermoplastic structural members adapted to be interconnected by sliding groove and finger joints, said beam comprising a rectilinear aluminum box beam of substantially greater depth than width and having short latterly extending flanges at the top and bottom thereof, and a rectilinear thermoplastic sleeve adapted to receive said aluminum box beam, said sleeve being formed with locking grooved adjacent to the top and bottom thereof and being of reduced width outwardly of said locking grooves towards the top and bottom thereof, said locking grooves being adapted for interlocking connection with structural member of the system with which it is to be used, said aluminum beam having the flanges thereof located in the reduced width portions of said sleeve outwardly of said locking grooves and a metal support bracket for supporting the end of said composite beam.

15. The combination of Claim 14 in which said metal support bracket is in the form of a shelf having a bottom wall, side walls and a back wall formation adapted to abut against a hollow structural supporting wall member which is adapted to receive concrete or the like therein, said back wall formation having flanged arms projecting therefrom for projecting into the interior of a supporting hollow wall member to be anchored therein upon introduction of concrete of the like into such hollow wall member.

16. The combination as claimed in Claim 15 in which said flanged arms have flanges projecting in two different planes.

17. The combination as claimed in Claim 15 or 16 further including a cap member for said composite beam and a plate like clip member for insertion into a supporting hollow wall member,said clip member having means for engagement under said flanged arms to anchor said clip against upward movement, and having hold down flange means at the top thereof adapted to overlie and hold down said beam cap member.

18. A bracket for supporting a load supporting beam formed of galvanized steel and presenting a shelf section having a bottom wall, side walls and a back wall formation from which extend spaced flanged arms adapted to be introduced into a hollow concrete receiving column member to be anchored thereto by the introduction of concrete therein, and a plate-like clip for bridging the space between said flanged arms adapted to be introduced into such hollow member to block concrete flow into said shelf.

19. A bracket as claimed in Claim 17 in which said flanged arms have flanges projecting in two right angled directions.

20. A clip for anchoring a cap member on a beam supported in a bracket having projecting arms for insertion into a hollow wall member capable of receiving concrete or the like, said clip comprising a plate member for insertion into such a hollow wall member, said plate member having projections for engagement beneath the bracket arms, said plate member further having a hold down flange for overlying and holding down the beam cap member.

FIG. 1.

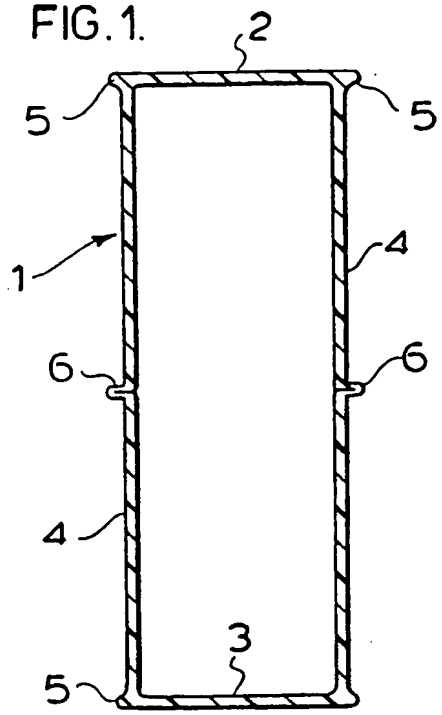


FIG. 2.

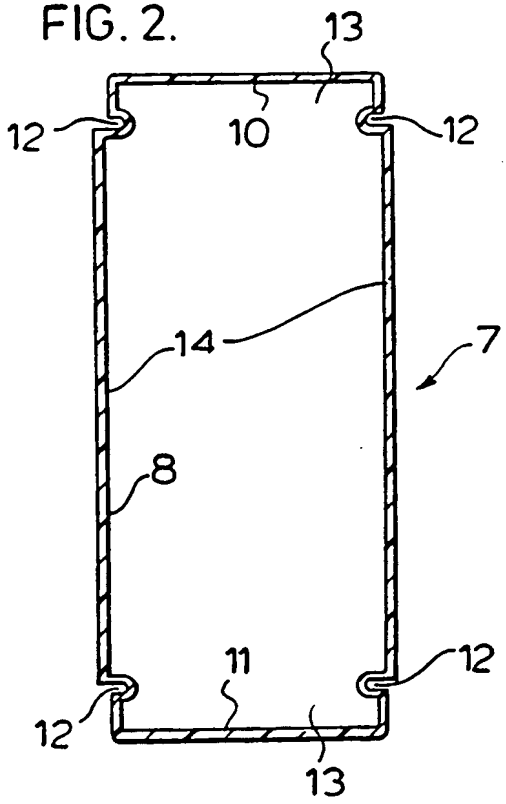


FIG. 3.

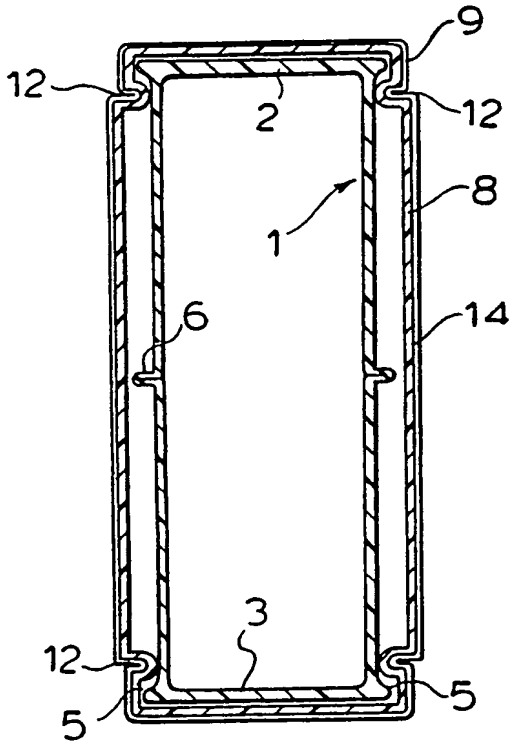


FIG. 4.

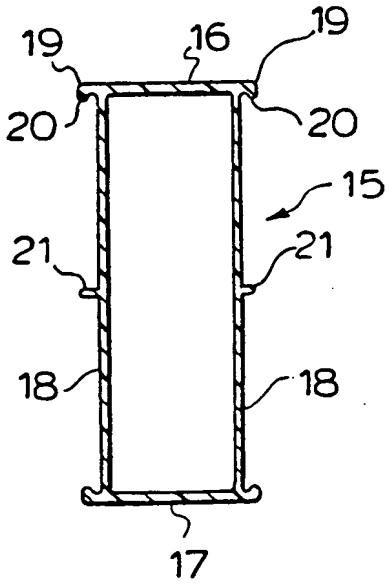


FIG. 5.

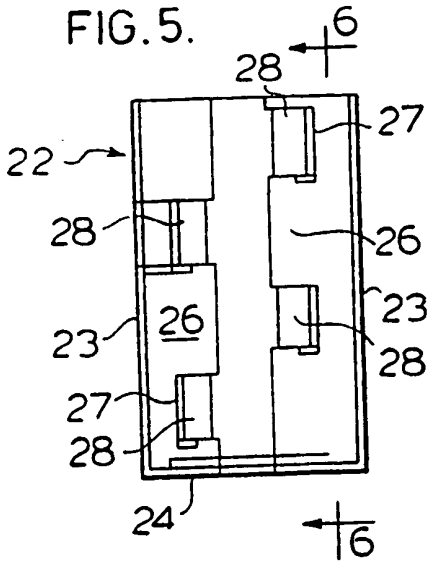


FIG. 6.

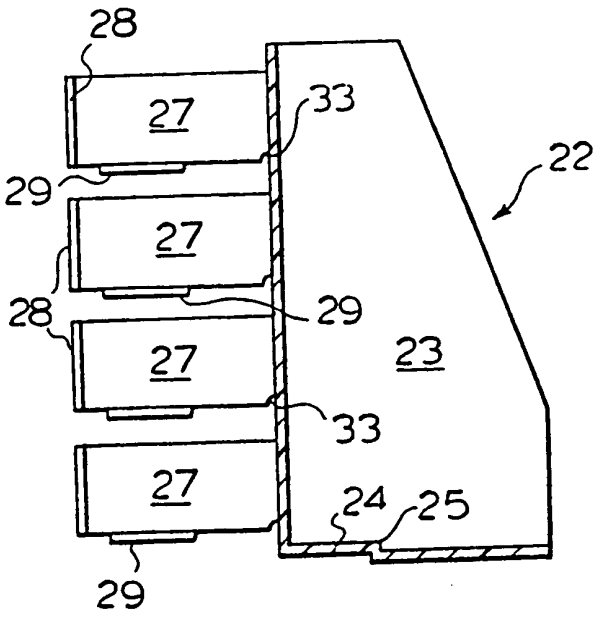


FIG. 7.

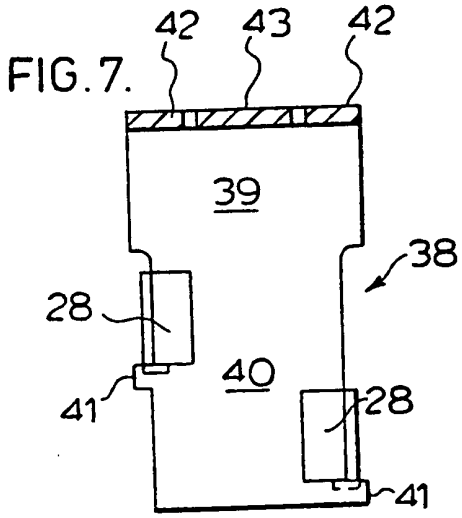


FIG. 8.

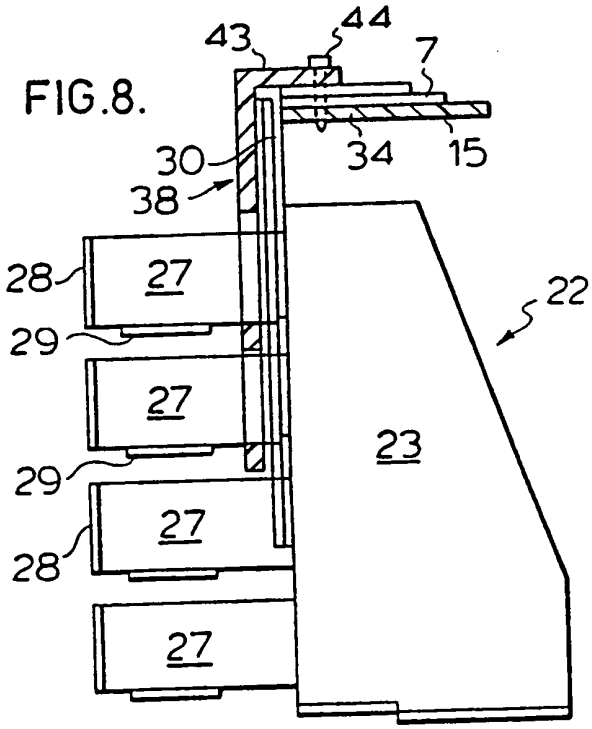
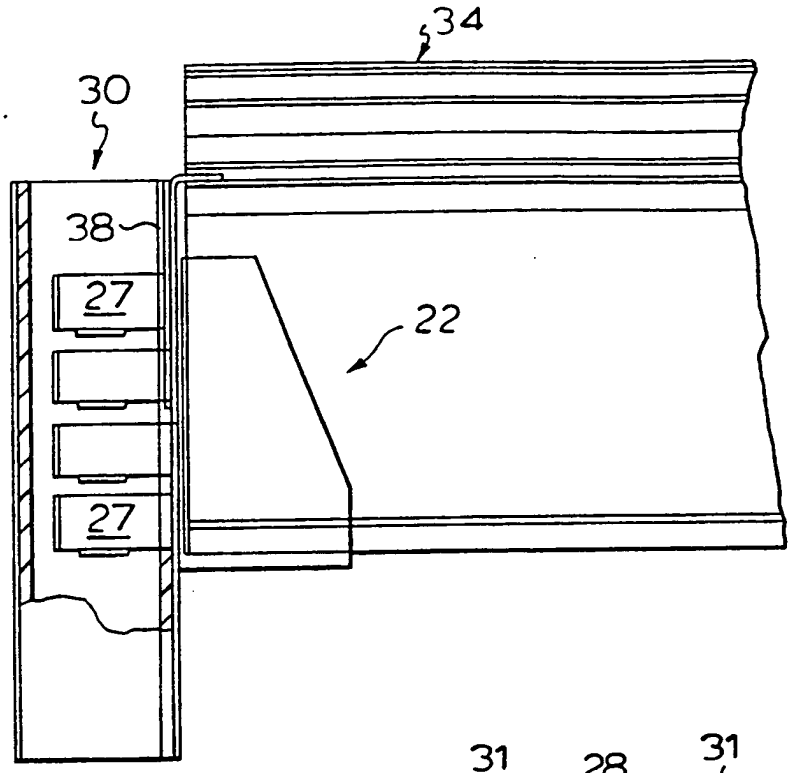


FIG.9.



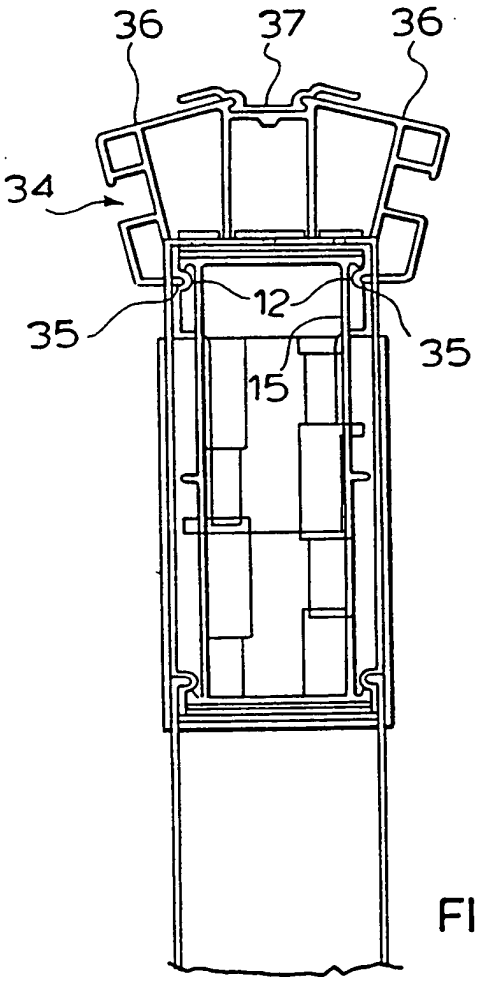


FIG.10.

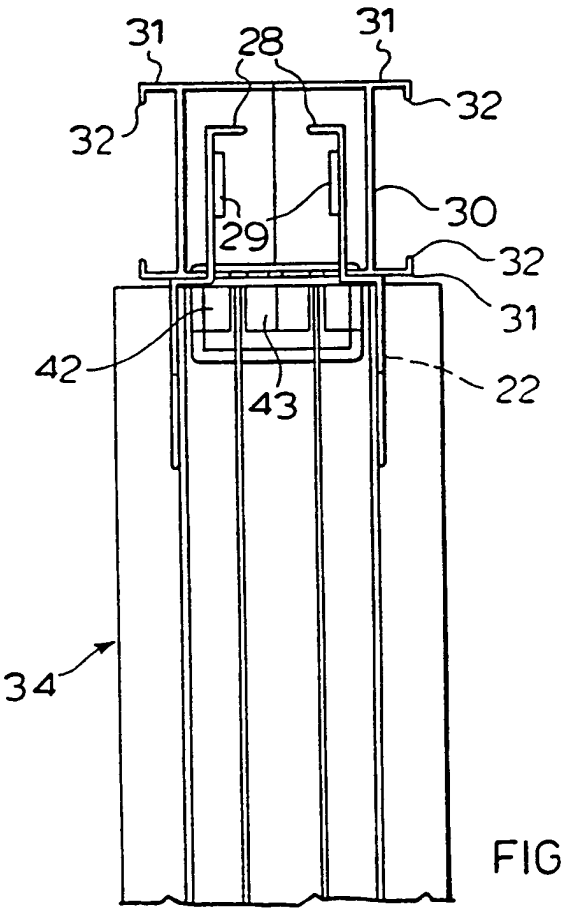


FIG.11.